

WHAT IS CLAIMED IS:

1. A lithographic projection apparatus comprising:
a radiation system that provides a beam of radiation;
a support structure that supports a patterning structure, the patterning structure configured to pattern the beam of radiation according to a desired pattern;
a substrate support that supports a substrate;
a projection system that projects the patterned beam onto a target portion of the substrate, said projection system including an optical element that has a beam entry area and an optical element that has a beam exit area through each of which said patterned beam passes; and
a nucleated surface associated with said projection system on which a plurality of nucleation sites are provided, said surface being disposed away from at least one of said beam entry area and said beam exit area.
2. A lithographic projection apparatus according to claim 1, wherein said nucleated surface is made of the same material as at least one of said optical elements.
3. A lithographic projection apparatus according to claim 1, wherein said nucleated surface comprises quartz.
4. A lithographic projection apparatus according to claim 1, wherein said nucleated surface comprises a rough texture.
5. A lithographic projection apparatus according to claim 1, wherein said nucleated surface includes at least one tube disposed on a surface, wherein said at least one tube is arranged on said surface so that said tube is offset from said beam entry or exit area in a direction of propagation of said patterned beam and is adjacent to either said beam entry area or said beam exit area.

6. A lithographic projection apparatus according to claim 1, wherein said nucleated surface forms part of a protective cap which fits over at least said exit or entry area of said projection system.

7. A lithographic projection apparatus according to claim 6, wherein said cap is provided with attachment elements for attaching said protective cap onto said projection system.

8. A lithographic projection apparatus according to claim 6, wherein a purge hood is disposed between said protective cap and said at least one of said entry or exit areas of said projection system.

9. A lithographic projection apparatus according to claim 1, wherein said nucleated surface is disposed in a gas cleaning system.

10. A lithographic projection apparatus comprising:

- a first radiation system that provides a beam of radiation;
- a support structure that supports a patterning structure, the patterning structure configured to pattern the projection beam according to a desired pattern;
- a substrate support that supports a substrate;
- a projection system that projects the patterned beam onto a target portion of the substrate, said projection system including an optical element that has a beam entry area and an optical element that has a beam exit area through each of which said patterned beam passes;
- a fluid cleaning system that cleans a fluid to be introduced into a region in which said optical element is disposed, said fluid cleaning system comprising
 - a fluid inlet that receives fluid to be cleaned and a fluid outlet that supplies cleaned fluid to said region of said apparatus,
 - a cleaning zone that cleans said received fluid, said cleaning zone being disposed between said inlet and said outlet, and

a second radiation system that provides radiation to said cleaning zone to cause dissociation of a contaminant present in said fluid in said cleaning zone; and

a nucleated surface provided with a plurality of nucleation sites, wherein said nucleated surface is disposed in said cleaning zone.

11. A lithographic projection apparatus according to claim 10, wherein said cleaning zone is disposed away from said beam entry area of said beam exit area.

12. A lithographic projection apparatus according to claim 10, wherein said radiation is incident on said nucleated surface.

13. A lithographic projection apparatus according to claim 10, wherein said cleaning zone comprises a chamber.

14. A lithographic projection apparatus according to claim 13, wherein said chamber includes a plurality of walls transparent to said radiation, said walls disposed so as to define a fluid path through which said fluid passes from said fluid inlet to said fluid outlet.

15. A lithographic projection apparatus according to claim 14, wherein said walls are arranged so that said fluid path has a length longer than a dimension of said chamber in a direction of propagation of said radiation.

16. A lithographic projection apparatus according to claim 14, wherein said walls are interleaved.

17. A lithographic projection apparatus according to claim 10, wherein said nucleated surface comprises a surface of foamed or glass wool.

18. A lithographic projection apparatus according to claim 17, wherein said foamed or glass wool is disposed in said chamber.

19. A lithographic projection apparatus according to claim 10, wherein said chamber is constructed so that the time it takes for said fluid to pass from said inlet to said outlet is sufficient to achieve dissociation of a contaminant in said cleaning zone.

20. A lithographic projection apparatus according to claim 10, wherein said nucleated surface is constructed so that the time it takes for said fluid to pass from said inlet to said outlet is sufficient to achieve association of a dissociated contaminant with said nucleated surface.

21. A lithographic projection apparatus according to claim 10, wherein the surface area of said nucleated surface is greater than the surface area of a lens comprised in said projection system.

22. A lithographic projection apparatus according to claim 10, wherein said nucleation sites are salt crystal growth seeds and said association includes the formation of salt crystals at or in the vicinity of said nucleation sites.

23. A lithographic projection apparatus according to claim 10, wherein said contaminants are retained on said nucleated surface as salt crystals.

24. A lithographic projection apparatus according to claim 10, wherein said first and second radiation systems are the same.

25. A lithographic projection apparatus according to claim 10, wherein said first and second radiation systems are independent from each other.

26. A lithographic projection apparatus according to claim 10, wherein said first and second radiation system provide radiation having substantially the same wavelength.

27. A lithographic projection apparatus according to claim 10, wherein said surface is replaceable.

28. A fluid cleaning system for use in an apparatus, said system comprising:
a fluid inlet that receives fluid to be cleaned and a fluid outlet that supplies cleaned fluid to an apparatus;
a cleaning zone disposed between said inlet and said outlet;
a radiation source arranged to be incident on said cleaning zone to cause dissociation of a contaminant present in said fluid in said cleaning zone; and
a nucleated surface disposed in said cleaning zone, on which a plurality of nucleation sites are provided.

29. A cleaning system according to claim 28, wherein the fluid to be cleaned at least one of air, nitrogen, argon, helium, water, and oil.

30. A method of cleaning a fluid for use in an apparatus, said method comprising:
receiving a fluid to be cleaned at an inlet and supplying a cleaned fluid to an apparatus at an outlet;
cleaning said fluid in a cleaning zone disposed between said inlet and said outlet;
using a radiation source to cause dissociation of a contaminant present in said fluid in said cleaning zone; and
providing a nucleated surface in said cleaning zone, on which a plurality of nucleation sites are provided.

31. A method comprising using a fluid in a lithographic apparatus cleaned according to the method of claim 30.

32. A device manufacturing method comprising:

- projecting a beam of radiation;
- patterning the beam of radiation;
- projecting the patterned beam of radiation using an optical element having a beam entry area and an optical element having a beam exit area through each of which said patterned beam passes, onto a target portion of the layer of radiation-sensitive material; and
- capturing contaminants with a plurality of nucleation sites spaced from at least one of said beam entry area and said beam exit area.

33. A contamination detector for detecting contaminants in a fluid, the detector comprising:

- a fluid path along which the fluid flows;
- a detection zone disposed in said fluid path;
- a radiation source arranged to be incident on said detection zone, wherein said radiation source causes dissociation of a contaminant present in said fluid in said detection zone;
- a nucleated surface disposed in said detection zone, on which a plurality of nucleation sites are provided; and
- an optical measuring device for determining an optical characteristic of said nucleated surface from which concentration of a contaminant in said fluid is determined.

34. A detector according to claim 33, wherein said characteristic is transmissivity or reflectivity.